DEMANDE INTERNATIONALE PUBLIEE EN VERTU DU TRAITE DE COOPERATION EN MATIERE DE BREVETS (PCT)

(51) Classification internationale des brevets[4] : F16L 19/02

A1

(11) Numéro de publication internationale: WO 89/ 03495

(43) Date de publication internationale: 20 avril 1989 (20.04.89)

(21) Numéro de la demande internationale: PCT/FR88/00465

(22) Date de dépôt international: 20 septembre 1988 (20.09.88)

(31) Numéro de la demande prioritaire: 87/14265

(32) Date de priorité: 9 octobre 1987 (09.10.87)

(33) Pays de priorité: FR

(71) Déposant *(pour tous les Etats désignés sauf US)*: EFEREL S.A. [FR/FR]: 1, rue des Cent-Arpents, Saint-Germain-de-la-Grange, F-78640 Neauphle-le-Château (FR).

(72) Inventeur; et

(75) Inventeur/Déposant *(US seulement)* : GENOU, Patrick [FR/FR]: 23 bis, rue Hélène-Boucher, F-78960 Voisins-le-Bretonneux (FR).

(74) Mandataire: CABINET MOUTARD: 35, avenue Victor-Hugo, F-78960 Voisins-le-Bretonneux (FR).

(81) Etats désignés: AT (brevet européen), BE (brevet européen), CH (brevet européen), DE (brevet européen), FR (brevet européen), GB (brevet européen), IT (brevet européen), JP, LU (brevet européen), NL (brevet européen), SE (brevet européen), US.

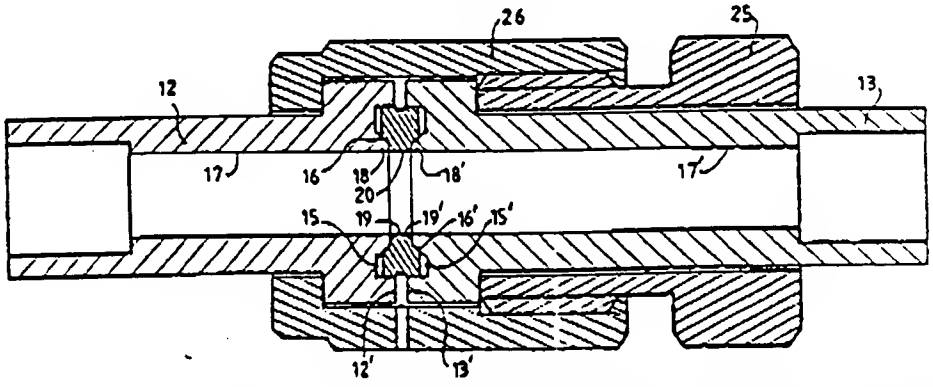
Publiée

Avec rapport de recherche internationale.

(54) Title: CONNECTOR WITH INTERCHANGEABLE ANNULAR METAL JOINT

(54) Titre: RACCORD A JOINT METALLIQUE ANNULAIRE INTERCHANGEABLE

(57) Abstract



The connector according to the invention is intended to provide for a sealed connection between two tubular elements arranged end to end and respectively provided with two tubular connecting ends (12, 13), the sealing being obtained by compression of an annular gasket or ring (20) between the radial faces (12', 13') of the two ends (12, 13). The radial faces of the ring (22) and of the ends (12, 13) comprise each a coronal radial surface adjacent to the cylindrical surface of the ring (20) and of the ends (12, 13) as well as, outwardly, a revolution surface of which the directrix is a circle and of which the generatrix extends obliquely with respect to the longitudinal axis of the connector. The invention also provides for a continuity of the internal cylindrical surface (17, 17:) of the connector. a self-centering effect on the ring (20) and a double sealing barrier.

(57) Abrégé

Le raccord selon l'invention sert à assurer une connexion étanche entre deux éléments tubulaires disposés bout à bout respectivement munis de deux embouts tubulaires (12, 13); l'étanchéité étant alors obtenue par compression d'un joint annulaire (20) entre les faces radiales (12', 13') des deux embouts (12, 13). Les faces radiales du joint (20) et des embouts (12, 13) comprennent chacune une surface radiale coronale adjacente à la surface cylindrique du joint (20) et des embouts (12, 13) ainsi que, vers l'extérieur, une surface de révolution dont la directrice est un cercle et dont la génératrice s'étend obliquement par rapport à l'axe longitudinal du raccord. L'invention permet d'assurer une continuité de la surface cylindrique intérieure (17, 17') du raccord, d'assurer un effet d'auto-centrage du joint (20) et d'obtenir une double barrière d'étanchéité.

U.S. Patent Application Serial No. 07/599,069 for "Sealing System for Connecting VCR-Type and Plane Coupling Hardware"

COUPLING PIECE WITH REPLACEABLE TOROIDAL METAL CONNECTION

The invention relates to a coupling piece with a replaceable toroidal metal connection designed to ensure sealed coupling of two tubular elements positioned end to end by compressing the connection between the opposite ends of these elements.

Generally speaking, coupling elements having, on the two facing ends of the tubular elements to be coupled, two corresponding tubular adapters shaped or built up (as by welding) on the said ends are currently known to be used in many conduits, especially pipelines employed to convey possibly toxic gases.

Each of these adapters is usually shaped so that it has a flange and also a radial surface provided with a generally semitoroidal axially projecting sealing surface coaxial with the adapter.

Sealing at the level of the coupling is then achieved by tightening a toroidal metal connection with rectangular axial cross-section between the radial surfaces of the two adapters.

It is found that coupling pieces of this kind preclude assurance of continuity of interior shape of tubular elements and adapters, at the level of the connection. On the other hand, it is also found that dead spaces are formed between the connections and the radial surfaces of the adapters, spaces in which solid or liquid particles may be trapped and create the risk of contaminating fluids subsequently flowing through the coupling piece.

It is accordingly the aim of the invention to eliminate this disadvantage; it proposes for this purpose a connection of the type indicated in the foregoing, one in which:

- the radial surface of at least one of the adapters is shaped so as to have, in an area adjacent to the interior cylindrical surface of this adapter, a toroidal projection ending in a coronal plane radial surface that extends to said cylindral surface, and also, toward the exterior, a surface of revolution whose directrix consists of a circle coaxial with the adapter and whose generatrix extends obliquely relative to the longitudinal axis of the adapter;

- the metal connection comprises an interior cylindrical

surface of the same diameter as the interior surface of the adapter, and also at least one radial surface having a plane coronal surface that extends radially from said interior surface and to which the coronal plane surface of the adapter can be applied, along with a surface of revolution more or less complementary to that of the adapter, toward the exterior of the connection.

The respective positions of the coronal plane surfaces and the surfaces of revolution of the connection and the adapter are provided in such a way that, when the adapters are tightened together, the surfaces of revolution ensure self-centering of the connection before the coronal plane surfaces are applied to each other, uniformly, over a circular area coaxial with the adapter, and, at the end of the clamping process, the plane coronal surfaces come to fit against each other.

These respective positions could be provided in such a way as to cause compression of the connection at the level of the surfaces of revolution to begin before or after the plane coronal parts come into contact, the purpose being to limit as much as possible, in the first situation, warping of the interior surface of the connection, and in the latter the tightening torque needed to produce the necessary sealing.

It is obvious that the structure described in the foregoing results in the creation of two consecutive barriers, one at the level of the coronal surfaces, and the other at the level of the oblique surfaces.

The invention also proposes a universal connection that may be used simultaneously

- in a coupling piece of the conventional type such as has been defined in the foregoing, and

- in a connection such as is claimed for the invention.

Embodiments of the invention will be described in what follows by means of non-restrictive examples, with reference to the attached drawings, in which:

Figure 1 shows an axial section of a coupling piece of the conventional type;

Figure 2 is an axial section of a first embodiment of a coupling piece as claimed for the invention;

Figure 3 is a cutaway view on a larger scale of the connection used in the coupling piece shown in Figure 2; and

Figure 4 is an axial section of a coupling piece comprising an adapter of the conventional type, an adapter of a coupling piece claimed for the invention, and a connection suitable for these two adapters.

It is to be noted first of all that the coupling piece shown in Figure 1 corresponds to those currently in use in processing gas distribution circuits installed in thermochemical material processing systems.

This coupling piece comprises two cylindrical adapters 1, 2 with which each of the two facing ends of the two conduit elements to be coupled (not shown) are outfitted.

These adapters 1, 2 each comprise a flange 3, 3' serving the purpose of mechanical connection and ending in a radial surface 4, 4' provided with a toroidal axial projection semicircular in section that acts as a sealing surface.

Positioned between the radial surfaces 4, 4' of the two adapters 1, 2 is a toroidal metallic connection 6 rectangular in section and having two facing radial surfaces 7, 7' against which the sealing surfaces of the adapters 1, 2 can come to rest, two corresponding coaxial cavities 8 and 8' being formed after tightening.

Under the conventional method, the connection between the two adapters 1, 2 is tightened by screwing an externally threaded cylindrical sleeve 9, which is mounted around the adapter 1 and is retained in the axial direction by the flange 3, into an internally threaded cylindrical sleeve 10 mounted around the adapter 2 and retained in the axial direction by the flange 3.

It is clearly to be seen from Figure 1 that when this connection is in the tightened position there are dead spaces 11, 11' between the connection 6 and the two adapters 1, 2, in which spaces solid or liquid particles may be trapped.

The embodiment of the invention shown in Figures 2 and 3 makes it possible to avoid this disadvantage.

In this example, the radial surface 12', 13' of the adapters 12, 13 comprises a coaxial toroidal cavity 15, 15' with a cross-section in the form of an open rectangular trapezoid at the level of its larger base, in the plane of said surface 12', 13'.

The cavity accordingly comprises a tapering wall 16, 16' that is oriented toward the interior and that, together with the interior cylindrical surface 17, 17' of the radial surface

12', 13' of the adapter 12, 13, defines a toroidal axial projection 18, 18' ending in a coronal plane surface 19, 19' that extends in a plane perpendicular to the longitudinal axis of the adapters 12, 13.

The toroidal connection 20 used in this coupling piece has two opposite radial surfaces 21, 21' each comprising two coronal radial surfaces 22, 23 - 22', 23' axially offset relative to each other and connected to each other by a tapering part 24, 24' more or less complementary to the tapering wall 16, 16'.

In this example, the thickness of the connection 20 at the level of the coronal surfaces 23, 23' is less than its thickness at the level of the coronal surfaces 22, 22'.

The adapters are tightened by means of coupling elements (cylindrical sleeves 25, 26) such as those described in the foregoing and accordingly not described again.

In the tightening process self-centering of the connection 20 is ensured by interaction of the tapering walls 16, 16' of the adapters 12, 13 with the tapering parts 24, 24' of the connection 20. When tightening has been completed, these tapering parts 24, 24' are restrained by the tapering walls 16, 16', while the coronal radial surfaces 23, 23' of the connection 20 are themselves restrained by the coronal surfaces 19, 19' of the adapters 12, 13.

When in this position, which is to be seen in Figure 2, the coupling piece has no dead space accessible from the interior, and the coronal surfaces 19, 19' - 23, 23' are not in contact with the fluid passing through the coupling piece.

The connection may be reused and, because of the offset of the coronal surfaces 23, 23', its sealing surfaces cannot be scored when the connection is placed flat on a surface.

In the example shown in Figure 4, the connection includes an adapter 26 of the conventional type similar to those shown in Figure 1, and an adapter 27 made in conformity with the adapter of a coupling piece claimed for the invention. This coupling piece makes use of a universal connection 28 that may be employed both in a coupling piece of the conventional type such as the one shown in Figure 1 and in a coupling piece claimed for the invention, with two similar adapters.

As in the case of the conventional adapter, this adapter 27 comprises a radial surface 29 provided with a toroidal axial projection 30 semicircular in section identical to that 31 of adapter 26. In this instance, however, the portion of the

radial surface 29 connecting the inner edge 31 of this projection 30 and the interior cylindrical surface 32 of adapter 27 comprises in succession a cavity 33 vee-shaped in section, followed by a coronal plane radial surface 34 performing the same function as the coronal surfaces 19, 19' of the adapters 12, 13 used in the coupling piece shown in Figure 2.

The toroidal connection 28 used in this coupling piece comprises two opposite radial surfaces 35, 35' each having two coronal radial surfaces 36, 36' - 37, 37' axially offset relative to each other and connected to each other by a coaxial surface of revolution 39, 39' with a cross section more or less that of a quarter circle with a radius more or less equalling that of the projection 30, 31. The thickness of the connection 28, at the level of the coronal surfaces 36, 36', is then less than the thickness at the level of the coronal surfaces 37, 37'.

With respect to the adapter 26, the connection performs more or less the same function it would perform if a conventional connection were involved, the projection 31 restraining the connection 28 at the level of the projection's surface of revolution 39 and that of a narrow zone of the coronal radial surface adjacent to it, to create a single sealing barrier.

In contrast, application of the adapter 27 results in creation of two consecutive sealing barriers:

- one sealing barrier formed as a result of application of the coronal surface 34 of the adapter 27 to the coronal surface 37' of the connection 28; and

- a second sealing barrier formed by the action of the projection 30 of the adapter 27 on the connection 28.

The cavity 33 is then provided to reduce the surfaces in contact between the connection 28 and the adapter 27 and to allow creep of the material of the connection 28 into this cavity 33.

It must be pointed out that the hybrid coupling piece shown in Figure 4 does not reach all the goals sought by the invention, inasmuch as it allows a dead space 40 to exist between the connection 28 and the adapter 26, it being understood that this dead space 40 will be eliminated only if an adapter identical to the adapter 27 is used in place of the adapter 26.

It has been demonstrated that the connection 28 may be used equally well:

- for a hybrid coupling piece such as that shown in Figure 4,

- for a coupling piece using two adapters identical to the adapter 26 positioned symmetrically with respect to the radial plane of symmetry of the connection (line A, A'), and

- for a coupling piece using two adapters identical to the adapter 27 positioned symmetrically with respect to the radial plane of symmetry of the connection (line A, A').

This compatibility of the adapter 27 and the connection 28 with existing adapters, such as the adapter 26, in particular makes it possible gradually to replace the coupling pieces previously used in systems, without the need for providing a double set of adapters and replacement connections.

Claims

1. A coupling piece with a replaceable toroidal metal connection designed to ensure sealed coupling of two tubular elements positioned end to end, said coupling piece comprising, on the two facing ends of the tubular elements that are to be coupled, two corresponding tubular adapters shaped or built up on said ends, which have a radial surface provided with a toroidal sealing surface coaxial with the adapter, and also comprising means for axial tightening of the two adapters together for the purpose of restraining the connection between the sealing surfaces of the two adapters,

wherein

- the radial surface (12', 13' - 29) of at least one of the adapters (12, 13 - 27) is shaped so as to have, in an area adjacent to the interior cylindrical surface (17, 17 - 32) of this adapter (12, 13 - 27), a toroidal projection (18, 18') ending in a coronal plane radial surface (19, 19' - 34) that extends to said cylindral surface (17, 1' - 32), and also, toward the exterior, a surface of revolution (16, 16') whose directrix consists of a circle coaxial with the adapter and whose generatrix extends obliquely relative to the longitudinal axis of the adapter (12, 13 - 27);

- the metal connection comprises an interior cylindrical surface of the same diameter as the interior surface of the adapter, and also at least one radial surface having a plane coronal surface that extends radially from said interior surface and to which the coronal plane surface of the adapter can be applied, along with a surface of revolution more or less complementary to that of the adapter, toward the exterior of the connection.

- the metal connection (20, 28) comprises an interior cylindrical surface of the same diameter as the interior surface (17, 17' - 32) of the adapter 12, 13 - 27), and also at least one radial surface (21, 21' - 35, 35') having a coronal plane surface (23, 23' - 37, 37') that extends radially from said interior surface and to which the coronal plane surface (19, 19' - 34) of the adapter (12, 13 - 27) can be applied, and, toward the exterior of the connection, a surface of revolution (24, 24' - 39, 39') more or less complementary to that of the adapter (12, 13 - 27).

2. The coupling element as claimed in Claim 1, **wherein** the respective positions of the coronal plane surfaces (23, 23' - 37, 37' - 19, 19' 34) and the surfaces of revolution (24, 24' - 39, 39', 16, 16') of the connection (20, 28) and the adapter

(12, 13 - 17) are provided in such a way that, when the adapters (12, 13 - 27, 26) are tightened together, the surfaces of revolution (24, 24' - 39, 39' - 16, 16') ensure self-centering of the connection (20, 28) before the coronal plane surfaces (23, 23' - 37, 37' - 19, 19' - 34) are applied to each other, uniformly, over a circular area coaxial with the adapter (12, 13 - 27), and, at the end of the clamping process, come to fit against each other.

3. The coupling piece as claimed in Claim 1, wherein the adapter comprises a surface of revolution directly adjacent to it coronal plane surface.

4. The coupling piece as claimed in Claim 3, wherein the connection (20) includes a radial surface (21, 21') having a coronal radial surface (23, 23') adjacent to its interior cylindrical surface and a surface of revolution (24, 24') directly adjacent to said coronal radial surface.

5. The coupling piece as claimed in Claim 4, wherein the surfaces of revolution (16, 16' - 24, 24') of the adapter and of the connection are tapered.

6. The coupling piece as claimed in Claim 1, wherein the surface of revolution of the adapter (27) is produced on a toroidal axial projection (30) formed on the radial surface (29) of the surface of revolution (29).

7. The coupling piece as claimed in Claim 6, wherein the said radial surface (29) of the adapter (27) comprises, between its surface of revolution (projection 30) and its coronal radial surface (34), a circular cavity (33) coaxial with the adapter (27).

8. The coupling piece as claimed in Claim 6, wherein at least one of the radial surfaces (21, 21') of the toroidal connection (20) includes two coronal radial surfaces (36, 36' - 37, 37') axially offset relative to each other and coupled to each other by a surface of revolution (39, 39') at least in part complementary to that of the adapter (27).

9. The coupling piece as claimed in Claim 8, wherein the said surface of revolution (39, 39') have a cross section consisting of a fraction of a circle.

10. A universal connection that may be used in a coupling piece as claimed in Claim 1, wherein said universal connection comprises two opposite radial surfaces (35, 35') each having two coronal radial surfaces (36, 36' - 37, 37') axially offset relative to each other and coupled to each other by a coaxial surface of revolution (39, 39').

11. The universal connection as claimed in Claim 10, wherein the cross section of the said surface of revolution (39, 39') consists of a portion of a circle.

FIG. 1

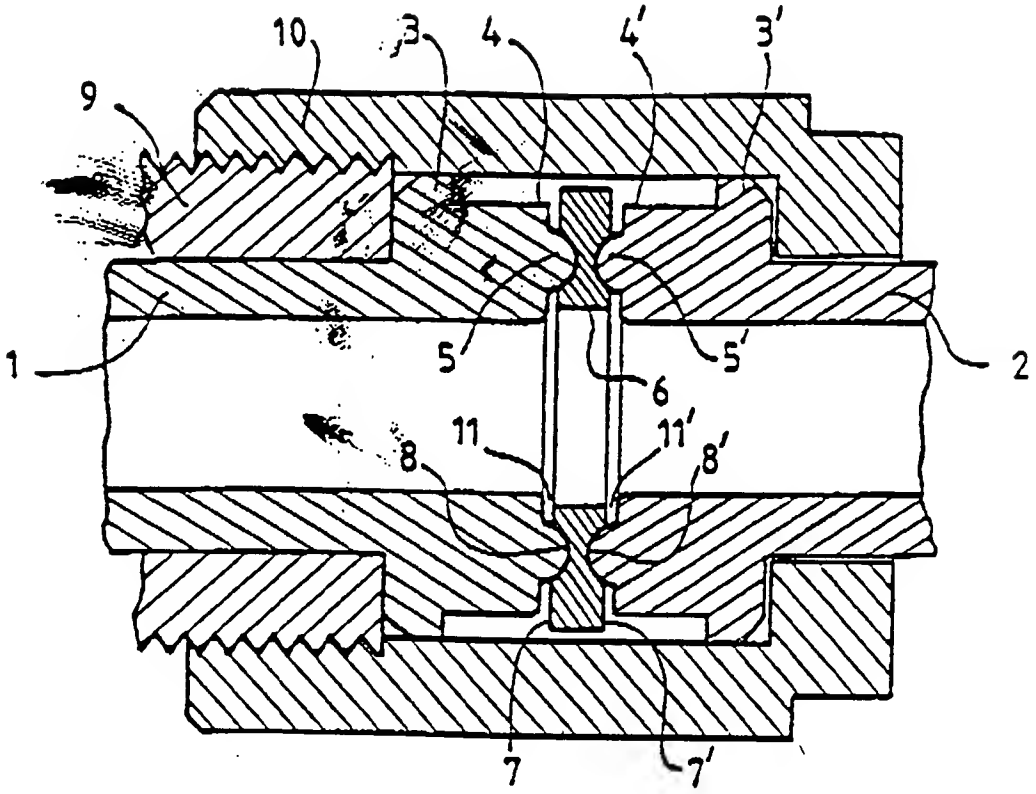

10
3
4
4'
3'
9
1
5
5'
2
6
11
11'
8
8'
7
7'

FIG. 4

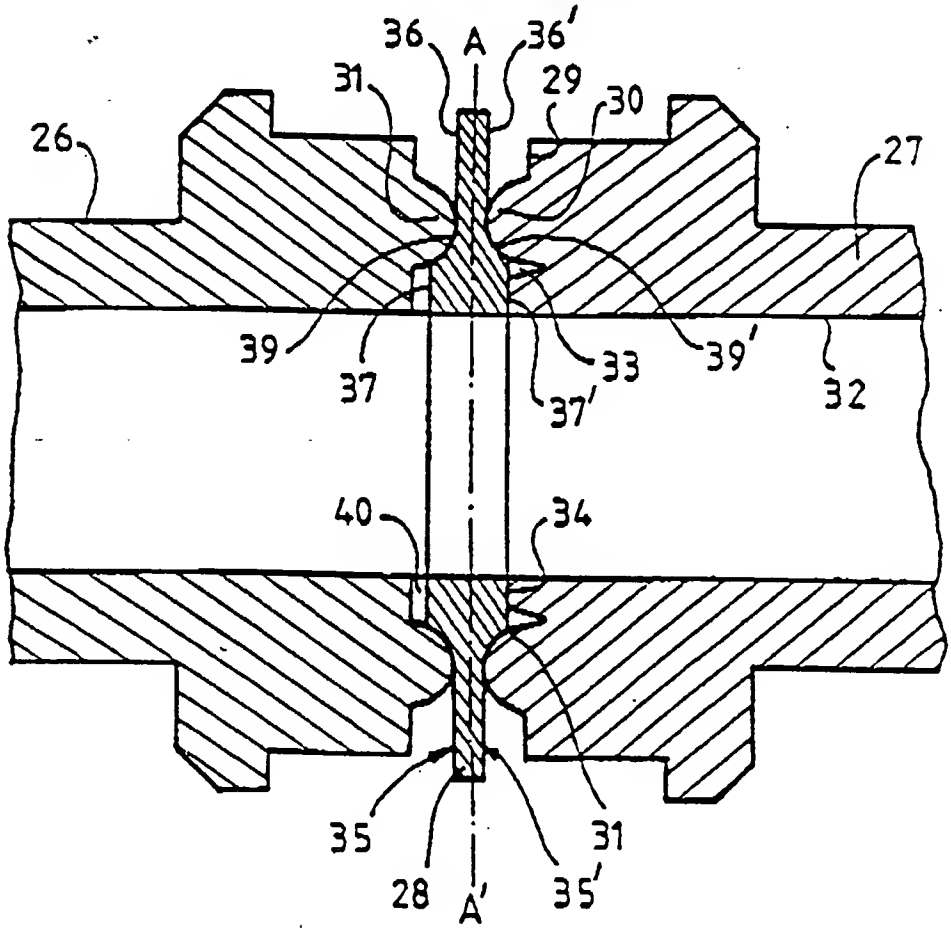

36
A
36'
31
29
30
26
27
39
37
33
39'
37'
32
40
34
35
31
28
A'
35'

FIG. 2

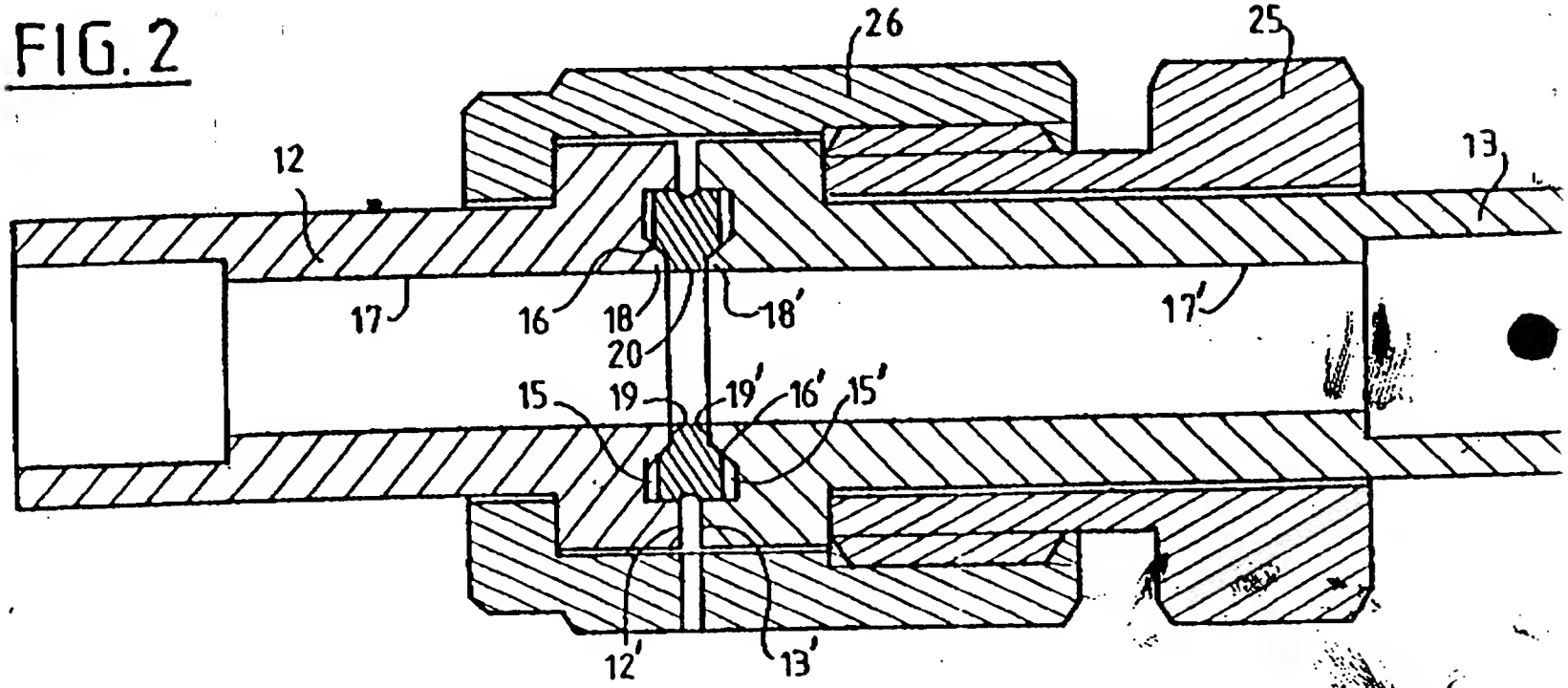


FIG. 3